1986 Quinquennial Review

BACKGROUND PAPER No.2

Regional Perspectives on Labour Force Change and the Impacts of Technology

City of Toronto Planning and Development Department
Robert E. Millward, Acting Commissioner
Research and Information Section
December 1986

Contents

1	**Introduction and Summary**	1
	The 1986 Quinquennial Review: Background Papers 1	
	Labour Force, Employment and Technological Change 1	
	Executive Summary 1	
2	**Labour Force Change**	3
3	**Occupational and Industrial Restructuring**	7
	Occupational Structure 7	
	Industrial Structure 8	
4	**The Information Economy**	10
5	**The New Technical Environment**	14
	Wide Area Networks 14	
	Local Area Networks 16	
	Technological Obsolescence in the Office Stock 16	
6	**Implications**	17
	References Cited	20
	Appendix	21

1 Introduction and Summary

1.1 The 1986 Quinquennial Review: Background Papers

The 1976 amendments to the Part I Plan for the Central Area put in place provisions which require, among other things, a review at five year intervals of certain aspects of the Plan and in particular, of indicators relating to the office deconcentration policies. A ten year review of these indicators is due in 1986. As part of the monitoring and research leading to the review, a series of background papers are being published dealing with a range of factors related to the rate and distribution of office, employment and population growth. Additional papers will also cover the impact of these factors on the transportation system.

The subject report, **Regional Perspectives on Labour Force Change and the Impacts of Technology,** comprises Background Paper No. 2. The report examines recent patterns of regional labour force growth and restructuring and attempts to assess the role that technology plays in the overall course of change.

1.2 Labour Force, Employment and Technological Change

Recent changes in the patterns of regional labour force growth, employment growth and occupational and industrial restructuring have introduced a new measure of uncertainty which has further complicated the process of long range planning. The process of change and the uncertainty it has engendered is reflected in the recent history of regional unemployment, growth in part-time work, women in the labour force and the general movement towards an information-based service economy.

Paralleling these changes, and to some extent propelling them, is a process of technological innovation. While much has been said in recent years about the "high tech revolution", we are only now beginning to understand what the impacts of these innovations are likely to be on labour and commercial real estate markets, the transportation system and travel behaviour and on notions of economic development, all matters of concern to the planning community.

This report explores some of the key elements in the overall process of change in the regional economy and where appropriate indentifies policy questions or suggests new directions for further inquiry. First, an examination of recent patterns of labour force growth and employment restructuring in the context of the "information economy" is presented. Secondly, the technologies thought to be 'driving' change are examined and their likely impacts assessed. Finally suggestions for an expanded monitoring program which would allow for more meaningful predictions of likely future predicaments to be faced by planners, is given.

1.3 Executive Summary

- Toronto's regional labour force grew by 45 percent between 1971 and 1981
- One in two new jobs created between 1971 and 1981 was either managerial or clerical in nature
- Women and part-time workers are comprising an increasing portion of the regional labour force

- Over 55 percent of the regional labour force is employed in occupations whose primary function revolves around the production, processing and distribution of information
- The development of the 'information economy' is paralleled by a process of technological innovation and the adoption of Wide Area Network (WAN), Local Area Network (LAN) and office automation technologies
- The development of 'smart buildings' may render portions of the existing office stock techologically, and hence functionally obsolete
- Technological innovations affect patterns of employment growth and bring into question the process of planning for transportation improvements and economic development

2 Labour Force Change

The labour force of the Toronto CMA constitutes the single largest labour pool in Canada. Of the 12.6 million Canadians in the labour force in 1985, 1.8 million or 14.2 percent live in the Toronto region. In fact, this represents more than 30 percent of the total Ontario labour force. The proportion of total employment is even higher at 14.8 percent of national and 38 percent of provincial employment levels (Table 1). On the other hand, unemployment rates in the region are typically lower, in 1985 at 6.8 percent compared to annual averages of 8.0 percent and 10.5 percent at the provincial and national levels respectively. In fact, the unemployment rate in the region tends to be the lowest among all urban regions in Canada.

Table 1
Labour Force Characteristics, Canada, Ontario and Toronto CMA
1985 Annual Average

	Labour Force '000s	Employment '000s	Unemployment '000s	Unemployment Rate %
Canada	12,639	11,311	1,328	10.5
Ontario	4,787	4,402	385	8.0
Toronto CMA	1,790	1,669	121	6.8

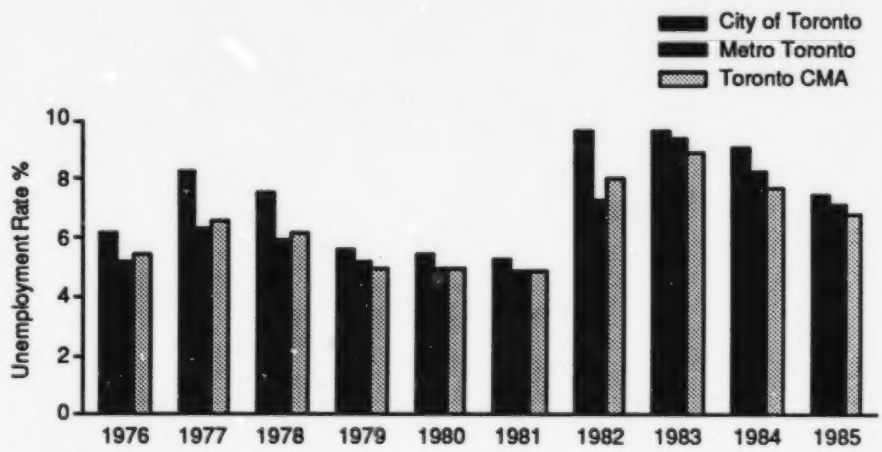
Source: Statistics Canada, Labour Force Survey

The period between 1976 and 1985 saw a rapid change in the character of the regional labour force, which grew in total from roughly 1.4 million to 1.8 million - an increase of 28.6 percent. The overall pattern of employment growth was similar, increasing from 1.3 million to 1.7 million. The recessionary period, (1981-83), however, was marked by a notable slowdown in the rate of employment growth. In fact, at the peak of the recession in 1983, the unemployment rate reached 10.3 percent with 170,000 unemployed. Since 1983, job creation in the region has improved dramatically. Unemployment has declined to about 100,000 and the unemployment rate has dropped to pre-recession levels of approximately six percent (Figure 1).

In Metro, the labour force grew from 729,000 in 1976 to 870,000 in 1985 and employment expanded from 687,000 to 816,000. Meanwhile, the unemployment rate went from 5.2 percent in 1976 to 9.4 percent at the height of the recession and has since dropped to 7.3 percent.

Labour force and employment growth in the City were somewhat slower over the 1976-85 period, increasing by 14.4 percent and 12.8 percent respectively (Table 2). Unemployment rates were slightly higher in the City, going from 6.5 percent in 1976 to 11.3 percent in 1983. The annual average unemployment rate in 1985 stood at 7.5 percent.

Figure 1
Unemployment Rates in the City of Toronto
Metro Toronto and Toronto CMA
1976 - 1985



Source: Labour Force Survey

Table 2
Labour Force Characteristics, City Of Toronto
1976-1985

	Population 15+ (000's)	Labour Force (000's)	Employment (000's)	Unemployment (000's)	Unemployment Rate %	Participation Rate %
1976	497.5	324.2	304.0	20.2	6.2	65.1
1977	496.4	331.2	303.8	27.4	8.3	66.7
1978	500.9	333.6	308.4	25.1	7.6	66.6
1979	504.0	347.5	328.0	19.6	5.6	69.0
1980	497.4	333.8	315.6	18.3	5.5	67.1
1981	486.3	338.7	320.7	18.1	5.3	70.0
1982	477.1	320.7	289.6	31.2	9.7	67.2
1983	496.2	337.6	305.2	32.4	9.6	68.0
1984	494.6	343.6	312.4	31.3	9.1	69.5
1985	523.5	370.9	343.0	27.9	7.5	70.8

Source: Statistics Canada Labour Force Survey

Two additional features characterise the pattern of regional labour change over the 1976-85 period - an increase in the female labour force participation rate and the growing importance of part-time work.

Over the 1976-85 period, male participation rates remained relatively stable at around 81 percent (Table 3). Female rates, on the other hand, went from 53.0 percent to 62.5 percent. In Metro, the percentage of working age females in the labour force went from 52.7 percent to 60.4 percent, while in the City it went from 54.7 percent to 64.4 percent (Figure 2). This suggests that the labour

force and employment growth noted above (which, in fact, outstripped population growth), is in large part due to increases in the number of women entering the labour force. In many instances, the jobs taken by women are of the low paid clerical and service variety.

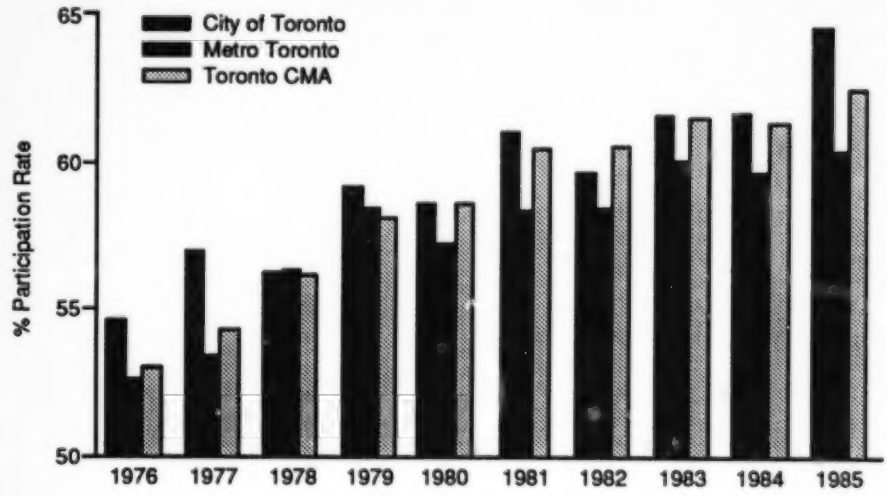
Table 3
Participation Rates, City of Toronto, Metro Toronto and Toronto CMA
1976-1985

		City %	Metro %	CMA %
1976	Male	77.2	81.0	81.4
	Female	54.7	52.7	53.1
1977	Male	77.4	80.6	81.2
	Female	57.0	53.5	54.4
1978	Male	77.5	81.6	81.9
	Female	56.3	56.4	56.2
1979	Male	79.7	82.3	82.7
	Female	59.2	58.5	58.2
1980	Male	76.4	80.4	81.7
	Female	58.6	57.3	58.6
1981	Male	79.3	81.7	83.4
	Female	61.0	58.4	60.5
1982	Male	75.6	80.4	81.8
	Female	59.7	58.5	60.6
1983	Male	75.4	79.7	80.9
	Female	61.6	60.1	61.5
1984	Male	77.6	78.4	81.0
	Female	61.7	59.7	61.4
1985	Male	77.8	79.1	80.7
	Female	64.6	60.4	62.5

Source: Statistics Canada Labour Force Survey

Part-time work in the Toronto region has also increased dramatically. By 1985, over 200,000 workers in the region worked less than twenty hours per week. In the City, over 40,000 had part-time jobs in 1985. This represents roughly 12 percent of the labour force compared with seven percent in 1976 (Table 4). To the extent that employment levels in 1985 had recovered from losses incurred during the recession, the take-up of part-time work is partially responsible. In fact, data from the Metro Employment Survey on employment and part-time work in the City suggest that of the increase of 34,000 jobs after 1983, roughly 14,000 (42 percent) were part- time in nature.

Figure 2
Female Participation Rates
Metro Toronto and Toronto CMA
1976 - 1985



Source: Labour Force Survey

Table 4
Part-Time, Full-Time And Total Employment, City Of Toronto, 1976-1985

	Part-Time '000s	% Change	Full-Time '000s	% Change	Total '000s	% Change	Part-Time/ Total Ratio
1976	22.4		281.6		304.0		0.07
1977	30.2	34.8	273.6	-2.8	303.8	-0.1	0.10
1978	29.2	-3.3	279.2	2.0	308.4	1.5	0.10
1979	31.3	7.2	296.7	6.3	328.0	6.4	0.10
1980	23.7	-24.3	291.9	-1.6	315.6	-3.8	0.08
1981	28.4	19.8	292.3	0.1	320.7	1.6	0.09
1982	31.6	11.3	258.0	-11.7	289.6	-9.7	0.11
1983	36.8	16.5	268.4	15.7	305.2	5.4	0.12
1984	33.7	-8.4	278.7	3.8	312.4	2.4	0.11
1985	40.2	19.2	302.8	8.6	343.0	9.8	0.12

Source: Statistics Canada, Labour Force Survey

Given possible differences in the travel behaviour of women and part-time workers, (i.e. transit orientation and off-peak travel), the continuation of the trends outlined above should be monitored, especially as they relate to the need for transportation investments in the future.

3 Occupational and Industrial Restructuring

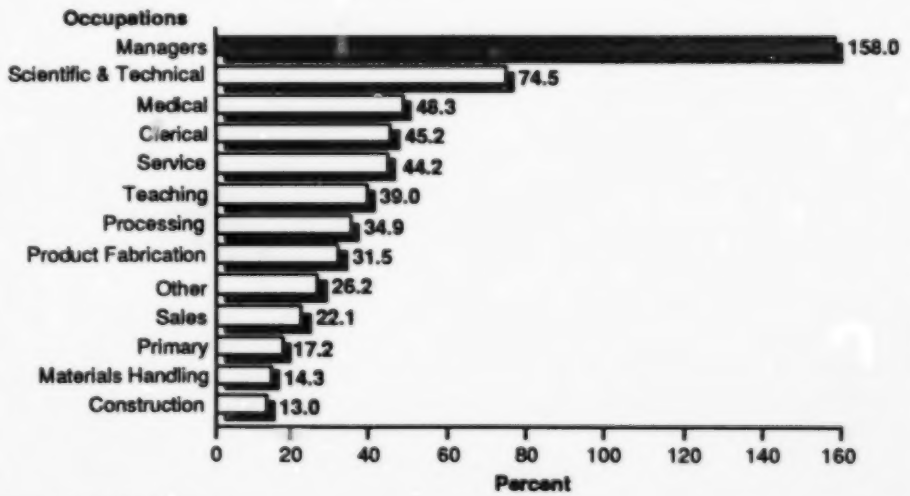
The manner in which the regional labour force is being employed has also undergone a radical transformation. This is true not only of the occupations in which people are being employed, but also of the relative importance of different industries as sources of new employment opportunities. While the changing structure of employment in the regional labour force, as measured by occupation and industry, is part of broader national and international processes, the social and economic context of change in the Toronto region is to some degree unique.

3.1 Occupational Structure 1971 - 1981

In absolute terms, the labour force of the Toronto Census Metropolitan Area (CMA) grew by 516,650 or 44.9% between 1971 and 1981. It is interesting, however, to examine how this growth translates into the occupations in which people are being employed.

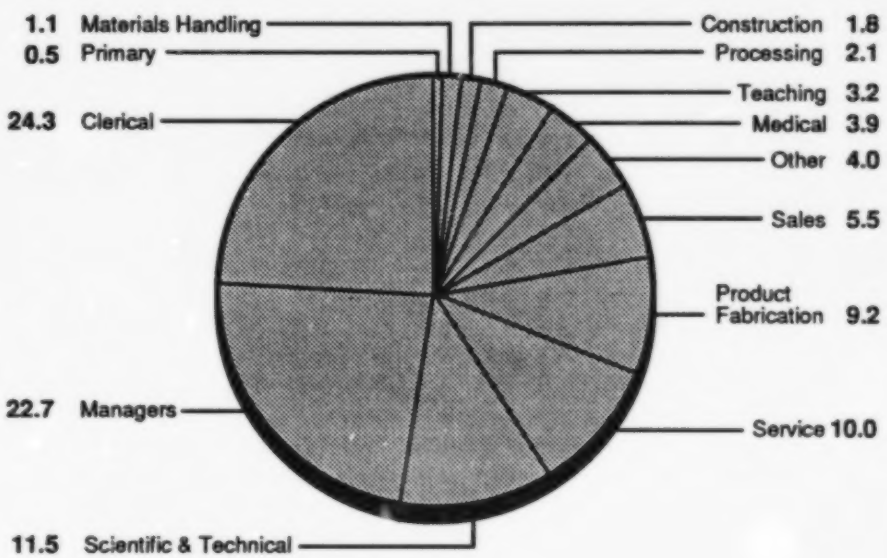
The Toronto Region's continuing importance as the administrative centre of Canada is best shown by its level of managerial and administrative employment which grew at a rate of 158% between 1971 and 1981 (Figure 3). This was followed by an increase of 74.5 percent in the number of scientific and technical workers. Together, these two occupational groups accounted for approximately one-third of the growth in the employed labour force (Figure 4). Job opportunities in the traditional manufacturing occupations were fewest. While in relative terms, the growth of processing, product fabrication and materials handling occupations seems strong (34.9%, 31.5% and 14.3% respectively), together their share of employment growth between 1971 and 1981 was only 13.4 percent.

Figure 3
Percent Change in Labour Force by Occupation
Toronto CMA
1971 - 1981



Source: Statistics Canada

Figure 4
Percent Share of Labour Force Growth by Occupation
Toronto CMA
1971 - 1981



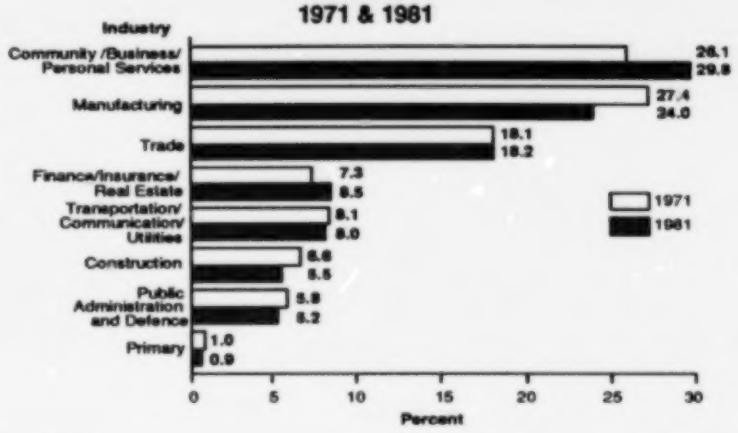
Source: Statistics Canada

A comparison of the growth in managerial and administrative employment with growth in clerical occupations, indicates that a polarisation of the labour force may be occurring. Whereas in relative terms, growth in clerical occupations ranked fourth, its growth in absolute terms was highest and accounted for 24.3 percent of all employment growth. In fact, almost one in two job opportunities coming available in the 1971 - 1981 period were either managerial or clerical in nature.

3.2 Industrial Structure 1971 - 1981

The industrial structure of the Toronto Region's labour force has also undergone some major changes. Traditional industries have declined in relative importance, others have increased and new job opportunities are shifting to new sectoral sources. Between 1971 and 1981, the relative shares of employment in primary, manufacturing and construction industries all declined (Figure 5). On the other hand, Trade, Finance,Insurance and Real Estate and Community Business and Personal Services each employed a larger share of the regional labour force in 1981 than in 1971. By 1981, Community Business and Personal Services alone employed almost 30 percent of the regional labour force.

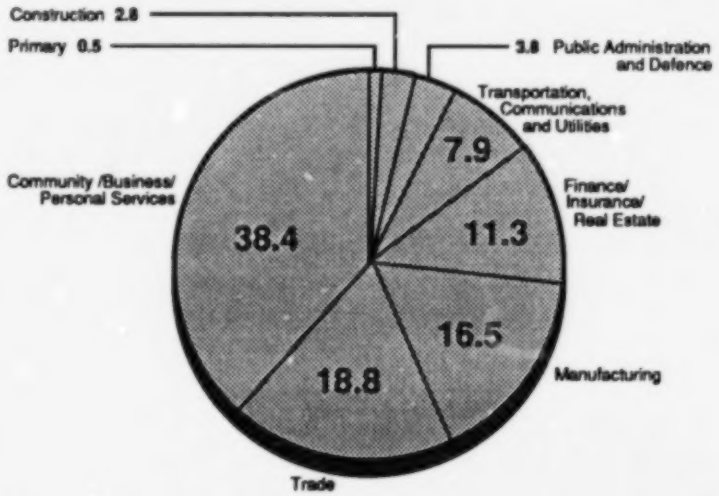
Figure 5
Percent Share of Toronto Labour Force by Industry Group
Toronto CMA
1971 & 1981



Source: Statistics Canada

This pattern of change is reflected in the shares of employment growth accounted for by different industries (Figure 6). In absolute terms, all industries, in fact, experienced some employment growth, including fairly significant growth in manufacturing. Outstripping all sectors, however, was the growth in the community business and personal services sector. Fully 38 percent of all employment growth was accounted for by this sector. As a result, it is now the single largest employer in the Toronto Region.

Figure 6
Percent Share of Total Labour Force Growth by Industry
Toronto CMA
1971 - 1981



Source: Statistics Canada

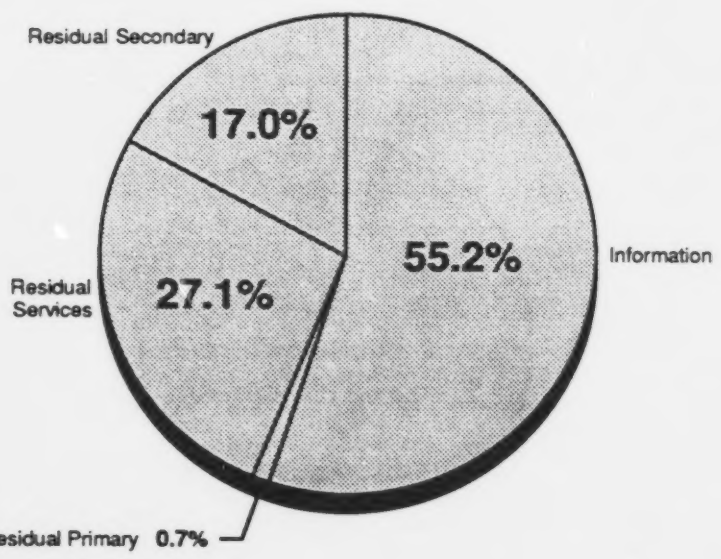
4 The Information Economy

The preceding description of occupational and industrial change illustrates the increasing importance of services in the regional economy. In fact, by 1981 over two-thirds of the regional labour force was employed in Community, Business and Personal services, Trade and Finance, Insurance and Real Estate.

The main characteristic of the service economy is the dominance of functions related to the production, processing and distribution of information. This has led to the coining of expressions such as "information economy" to describe the essential nature of the modern service economy. Unfortunately, metrics of the information economy have been few and far between. Perhaps the most useful method has been provided by Porat (1977). Using detailed occupation by industry matrices, the proportion of the labour force engaged in occupations whose primary function revolves around the production, processing and distribution of information is extracted. (For a description of the taxonomy of information occupations see Appendix).

Applying this method to the regional occupation by industry matrix reveals that in 1981, 55.2 % of the Toronto region's labour force was employed in the information sector (Figure 7). Based on this, it can be concluded that the Toronto region is an information-based service economy. Any analysis of the changing labour force and employment patterns should be considered in this context.

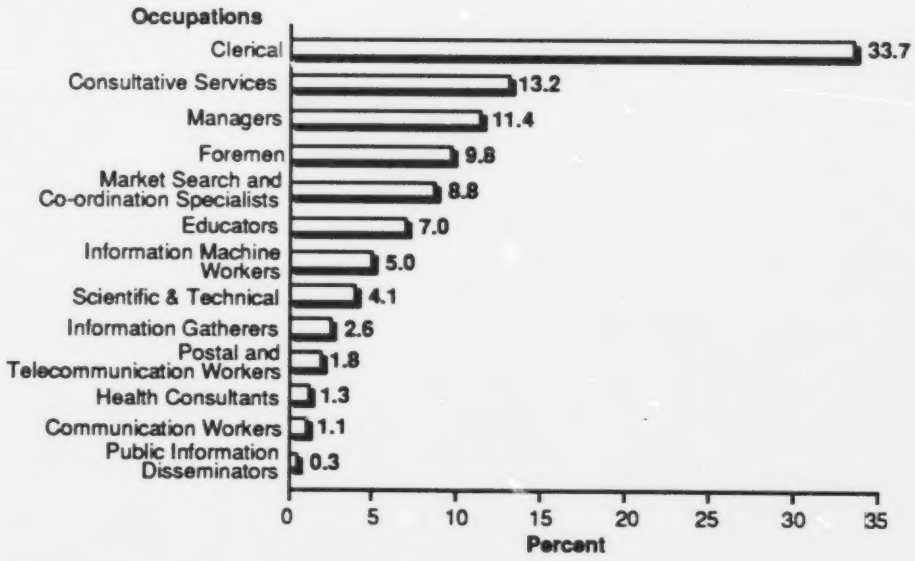
Figure 7
Information and Non-Information Sectors of the Toronto Region Labour Force 1981



Source: Statistics Canada

The strength of the region's office economy is reflected in the dominance of clerical work in the information labour force (Figure 8). Further, the status of the City of Toronto as a national centre for head offices is reflected in high concentrations of managers and administrators and consultative service occupations. The strength of the regional printing and publishing industries and the concentration of computer installations (48 percent of all installations in Canada), partially explains the relatively high proportion of information machine workers in the regional labour force (Table 5).

Figure 8
Occupational Composition of
The Information Labour Force
Toronto Region
1981



Source: Statistics Canada

Table 5
The Location Of Computer Capacity* In Canada's Largest Companies, December 1983

	Share of Total Computer Capacity in Each City (%)						
Industry Sector	**Toronto**	**Montreal**	**Ottawa**	**Winnepeg**	**Vancouver**	**Calgary**	**Rest of Canada**
Manufacturing	72.5	9.7	1.3	0.1	3.7	2.6	10.1
Oil	33.9	0.7	0.9	0.1	0.7	60.7	3.0
Agriculture, Fishing & Mining	12.3	8.3	—	4.0	13.9	9.7	51.8
Transportation	32.7	54.5	—	8.4	3.8	0.1	0.5
Finance, Insurance and Real Estate	54.8	11.8	7.0	11.2	5.7	2.1	7.4
Trade	69.3	10.5	—	2.8	13.3	0.8	3.3
Computer Services	**45.0**	**6.3**	**15.4**	**4.6**	**—**	**2.0**	**26.7**
Federal Government	**5.9**	**1.3**	**69.1**	**1.1**	**1.3**	**1.3**	**20.0**
All Sectors	**48.1**	**11.1**	**11.8**	**3.8**	**4.1**	**6.7**	**14.4**

* *Main memory size is used as a proxy measure of processing capacity (in Kilobits)*

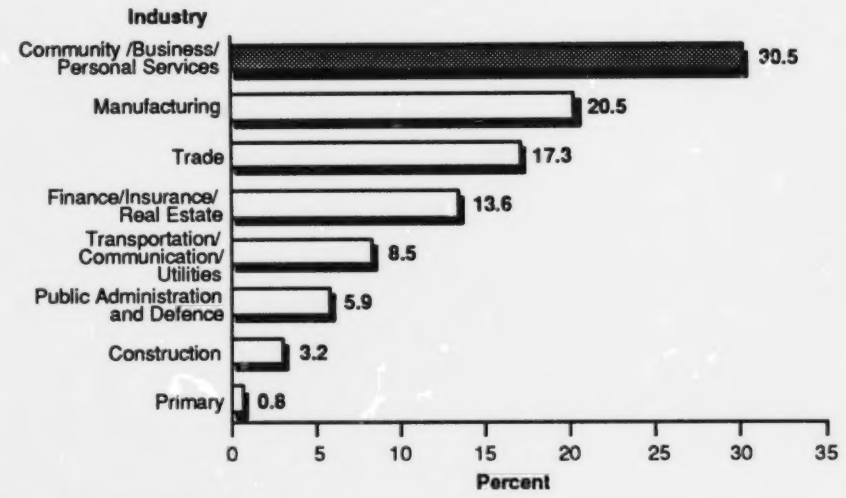
Source: *Canadian Information Processing Society (Toronto), 1983 Canadian Computer Census*

From: *Hepworth, M.E. (1986), "The Geography of Economic Opportunity in Information Society", Information Society Journal, Vol. 4, No. 3, June 1986*

By 1981, the service sector accounted for approximately three-quarters of the information labour force in the region (Figure 9). There is also, however, a large component of information workers in primary and secondary industries (Figure 10). To the extent that employment in manufacturing industries grew between 1971 and 1981, it is likely that a large proportion of this resulted from growth in information occupations rather than from direct production work. The relatively high proportion of information workers in the primary and secondary sectors is explained by the City of Toronto's role as a head office location for resource industries.

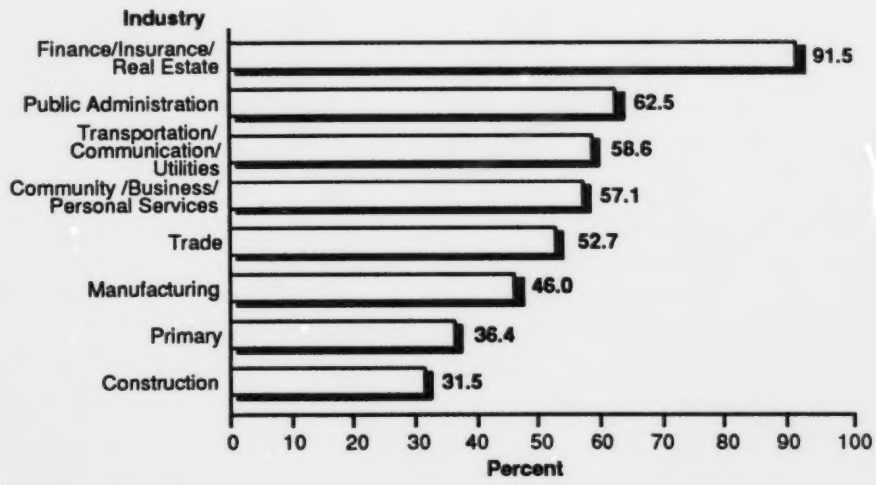
This alternative explanation for structural shifts in the regional labour force is provided to suggest that there may be few future alternatives for the region's labour force outside of the information sector. It also leads logically to a discussion of the process of innovation in information technologies and given that 55 percent of the regional labour force carries out tasks which can be automated, innovations in information technology should be of central concern. These innovations are working to alter the place and manner in which work is carried out. In fact, the City of Toronto has recently commissioned a series of studies which will focus on precisely how these innovations affect the Central Area.

Figure 9
Industrial Composition of The Information Labour Force
Toronto Region
1981



Source: Statistics Canada

Figure 10
Percent Information Workers by Industry Group
Toronto Region
1981



Source: Statistics Canada

5 The New Technical Environment

Paralleling the process of occupational and industrial restructuring outlined above, is a process of innovation in information technology. Innovations in, and the adoption of information technologies underline the increasing importance of information in the modern economy. The technologies are many and varied, but are developed on the assumption that information is central to any economic process and that major productivity gains can be achieved in an area where previously gains were lowest - the office. The primary technologies under discussion are computers and telecommunications which combine to form computer networks - the new infrastructure of the information economy. These networks are used by private firms and government agencies alike and their adoption is altering the manner in which goods and services are produced and exchanged. Inevitably, this innovation process has major impacts on the functioning of urban areas and is a process from which the City of Toronto is not immune.

5.1 Wide Area Networks

Throughout the 1970's and early 1980's, new and ever sophisticated applications of computer network technology were developed and now range from efficent flight scheduling in the airline industry to automated teller services in banking. The result is a new electronic infrastructure consisting of a variety of networks operated by individual organisations and used for inter-city communications.

The networks are used to produce and distribute information products and services either in the market or within firms themselves. In many respects, the transactions which occur along the networks represent a new form of inter-urban trade. To a large extent, the economic health of individual cities will depend on their ability to adapt and lead in the provision of information products and services.

The expectation is that the region of Toronto, and in particular the City of Toronto, will benefit from and increase its already dominant position with respect to information trade at the national level. There are several reasons for this supposition:

1. An increasing range of lower order (eg. word processing, payroll processing) and higher order (eg. management and research and development) information services are being produced at corporate head offices. Computer centres are invariably located at head offices and information products and services are distributed along the networks to branch offices. As the major head office location in Canada, the City of Toronto benefits directly from this geographical distribution of information activity.

2. Multi-locational firms in the information services sector (chartered banks, insurance companies etc.) are based in Toronto. These firms, by exploiting economies of scale in computing, are using networks to penetrate regional markets and are usurping small local firms.

3. The current cost structure of the telecommunications services industry confers an advantage on Toronto. For companies using computer networks, Toronto is the cheapest location within the new network infrastructure (Table 6).

4. While Canada as a whole is faced with intense international competition in information trade, non-tariff barriers exist which force multi-national firms to establish branches in Canada(1). It is expected that just as Toronto and its surrounding region gained from the past establishment of manufacturing branch plants, it will benefit from the new branch plant economy in information services. In fact, the same locational factors are again operating in Toronto's favour, i.e. large markets and accesibility - now defined by information and telecommunications services.

Table 6
Canadian Cities With Greatest Access to Data Communications Services
April 1984[1]

	Dedicated Line Services[2]		Public Packet Services[3]	
Rank	City	Accessibility Index	City	Accessibility Index
1	Toronto*	3.31	Toronto*	5.43
2	Ontario*	3.49	Hamilton*	5.53
3	St. Catherines*	3.55	Ottawa*	5.64
4	Hamilton*	3.56	London*	5.75
5	Kitchener*	3.71	Montreal	5.80
6	Montreal	3.74	Windsor*	6.10
7	Ottawa*	3.77	Quebec City	6.41
8	London*	4.01	Saint John	7.22
9	Sudbury	4.45	Winnepeg	7.60
10	Windsor*	4.46	Halifax	7.75

* *Denotes southern Ontario city*

1 *The accessibility index is calculated by summing the average costs of sending a packet of data or leasing a 601-1200 bps line between 23 metropolitan areas weighted by the 1981 information labour force. The costs are standardized for simplicity.*

2 *Telecom Canada's Dataroute Service (flat monthly leasing charge).*

3 *Telecom Canada's Datapac Service (transmission costs per packet only).*

From: *Hepworth, M.E. (1986), "The Geography of Economic Opportunity in Information Society," **Information Society Journal**, Vol. 4, No. 3, June 1986*

(1) For example, certain provisions of Canada's Bank Act require that foreign banks maintain a portion of their information handling and processing capabilities relating to Canadian depositors in Canada. Similarly, provincial legislation related to the securities and investment industry prevents foreign firms from operating fully from abroad, although considerable deregulation is being proposed by the current Ontario Liberal government.

5.2 Local Area Networks

The result of the broader level process of economic and technical change is increasing pressure on Toronto based firms to rationalise their local information handling functions. The response of local area firms has been to turn to Local Area Network (LAN) technology. LAN technology allows for the inter-connection of equipment (users) at a specific site such as an office building. The rationale for local area networks is to increase office productivity by automating clerical, professional and managerial tasks and integrating office systems.

As of yet, LAN technology is not in widespread use. It appears, however, that preparations for their use are already affecting the office market in Toronto. According to major LAN manufacturers, cable-based LAN technology will require users to either refurbish their existing office buildings or move to new buildings which have been designed specifically to accomodate these innovations. Indications from other countries suggest the latter option to be the most favourable (Bell, 1985). Members of the construction trades suggest in fact, that the costs associated with the renovation of large office buildings and the introduction of LAN cable may be prohibitive. This is especially true as the 'smart building' concept takes hold.

Smart buildings are founded on LAN technology and the integration of all office systems including heating, ventilation and air conditioning (HVAC) systems whose installation is significantly more complex than running cable through existing conduits. Interestingly, at the end of 1984 when the City's office vacancy rate stood at a record high 12 percent, the IBM Tower, Toronto's first smart building was 80 percent pre-leased - this several months prior to occupancy. At the end of 1985, vacancy rates remained high at 9.9 percent and the IBM Tower was fully occupied. While current data indicate that newer buildings have slightly higher vacancy rates than older buildings, as existing leases expire (18 percent in 1986 according to J.J. Barnicke Limited) this situation might be expected to change as tenants shift from old buildings to new. Should this occur, it would seem to suggest that demand in the office market is shifting towards a new type of space - space which better takes account of the needs of individual firms to improve their productivity in office activities.

5.3 Technological Obsolescence in the Office Stock

The need of individual organisations to improve their productivity in information handling and the enabling technology in the form of LANS may be rendering much of the existing office stock in the City of Toronto functionally obsolete. This phenomenon may partially explain the apparent confidence of the local development industry as it continues to build during a period of unusually high vacancy rates in the office market. In fact, it may prove necessary to assume higher equilibrium rates of office vacancy if local users of existing office space increasingly abandon it for newer 'smart space'. It appears necessary to develop a system for monitoring the magnitude of this intra-urban migration of office users and also market conditions in the LAN industry which affect both the scale and rate of technological obsolescence in the office stock.

6 Implications

At the risk of considerable over-simplification, it might be said that technological innovation is the engine which is now driving change in the regional labour and commercial real estate markets. At a minimum, technological innovation brings into question conventional wisdom with respect to employment change and projected growth and the likely future patterns of office space consumption and travel behaviour. These issues are of central concern in the Quinquennial Review. Several questions come to mind:

Does the apparent polarisation of the labour force in the information economy have a spatial expression?

Considerable discussion has recently focussed on what has been termed the 'executive city' (Gad, 1981). With the rapid growth of higher-order managerial and professional jobs on the one hand, and lower-order clerical jobs on the other, a geographical separation of where work is carried out in the region, has also come about. Background Paper No. 7 of this series, which uses Census journey-to-work data for the 1971- 81 period shows that trips into the Central Area by management and professional workers increased the fastest in both absolute (30,000) and relative (102 percent) terms. This was followed by an increase in trips by clerical workers of 25 percent. At the regional level, these two groups grew at a rapid but equal rate, thereby suggesting an increasing specialisation in management and professional functions in the Central Area. Should this trend continue, overall employment growth in the Central Area might be expected to be lower than current projections would suggest, as growth is increasingly accounted for by only a few professions. Furthermore, what net employment growth there is may impact less on the peak-hour transportation system serving the downtown, than comparable increases in the past due to differences in the travel patterns of management and professional workers.

Given the possibility of slower employment growth downtown, from where does the demand for additional floor space now in the planning process derive?

In 1960, the floor-space-per-worker (FSW) ratio in the Central Area was estimated to be roughly 207 square feet. By 1985, the FSW had increased to 280 square feet. With an increase in managerial and professional workers and the need for larger work areas to accomodate new office technologies, further increases in the FSW ratio might be expected. As an example, even assuming current office employment levels, (184,000 in 1985), a ten square foot increase in the FSW would, itself, account for two million square feet of additional absorption.

A further increase in the demand for office space, which is independent of any growth in employment derives from the need for technologically appropriate space. Intelligent buildings may be occupied by tenants vacating existing obsolete or 'dumb' buildings leading to a pattern of intra-urban firm migration which must be monitored. The effect of this migration may simply be to shift vacancies in the office stock between buildings. Transportation planning should, therefore, consider the geographical pattern of smart building office development especially in the face of such major developments as the Railway Lands which are separated from the locus of the existing transit system. Secondly, if refurbishment costs are too high and a large part of the existing office stock is deemed obsolete and becomes vacant, it falls to City Council to plan for incentives to refurbishment or the possible alternative use of the stock. Thirdly, the development approval process might be adjusted to consider the technological requirements of office space users in the appropriate

architectural and engineering context. For example, in its current Official Plan, the city of London, England has provided a number of suggestions which the development industry is encouraged to follow. These suggestions are designed to enhance the interior flexibility of London's office stock and include suggested floor plate sizes and specific criteria with respect to floor-to-ceiling heights(City of London,1986). While this is in clear recognition of the technological needs of the financial services industry in which London is a world centre, the City of Toronto might consider how such requirements might benefit local industry as it takes on an increasing national and international orientation.

How do technological innovations affect traditional notions of economic development?

The federal agency responsible for economic development, the Department of Regional Industrial Expansion (DRIE), deals with distributional issues from a sectoral perspective and has abandoned the regional approach taken by its predecessor, the Department of Regional Economic Expansion (DREE). This sectoral approach is based on the promotion of industries that have developed a comparative advantage, and in the Canadian economy this inevitably means a heavy reliance on the promotion of industries indigenous to Southern Ontario. While Toronto's regional economy stands to benefit by this approach, its constituent municipalities are left to fend for themselves in creating the necessary conditions, both political and socio-economic, for success.

This situation is not unlike the one which has arisen in the U.S.. The response of some U.S. cities has been to first recognize the central economic role of services in general and information services in particular. As Mitchell Moss (1985) points out, the future success and vitality of cities is increasingly dependent on the information which flows within and between them. In this regard, while the provision of telecommunications infrastructure and the creation of computer networks has historically been a private affair, several cities have come to regard these as an essential part of the 'hard' public infrastructure, along with roads, transit and sewers etc. In New York, for example, the Port Authority has not only promoted the installation of a teleport on Staten Island, but has also been instrumental in the creation of an 11 mile fibre optic link between the teleport and the Battery Park development in southern Manhattan. Similar policy initiatives have been taken in Minneapolis, San Antonio and Los Angeles (Blazar, Spector, Grathwol,1985)

Given the increasingly central role of services in the economy, promoting the City of Toronto as a centre for information exchange, and providing the necessary infrastructure to enable this, may become an important element in the City's future economic well-being. In addition, evidence suggests that services are no longer the servant of the manufacturing sector. Increasingly, the strength of the local information/service economy appears to have the ability to create new local manufacturing enterprises. Anecdotal evidence suggests that a recent merger in the retail trade sector and the subsequent rationalisation of the amalgamated firm's merchandising function based on computer network technology led not only to overall reorganization and a readjustment of its labour pool, but might also be correlated with a boom in development proposals in, among other things, the City's garment district. Planning in Toronto should consider economic development strategies in the context of this process of change.

Much of the preceeding discussion provides a speculative account of what the impacts of technological change on the City of Toronto's employment and office markets, as well as the transportation system might be. It is by no means an exhaustive account as several considerations

other than technology, must be accounted for. Rather, the discussion is meant to underscore the uncertainty with which we are likely to be faced. Secondly, it is meant to suggest that it is understanding the process of change, rather than simply the magnitude of growth, which will be the key to successful planning in the future. Thirdly, to mitigate against the vagaries of an uncertain future, it is suggested that the program of monitoring set out in the Official Plan be expanded to include the measurement of change and impacts arising from:

1. Technology and the 'Intelligent Building' phenomenon in the office sector

2. Intra-urban migration of office firms - particularly within the Central Area

3. Continued industrial and occupational restructuring

4. National and international processes of change with respect to the above

5. Economic development considerations i.e. the role of information services and telecommunications as public infrastructure

6. General economic conditions i.e. labour force and employment growth, women in the labour force, participation rates, unemployment etc.

Monitoring these processes will provide a better indication of how and where people are likely to be employed in the future. In addition, given the obvious link between LAN technology and office automation, it may be possible to monitor job redundacy and displacement and new forms of employment arising from the application of new technologies. Finally, our ability to effectively plan for future transportation improvements is highly dependent on the ability to predict future employment patterns. In light of the uncertainty created by the new technology, developing appropriate monitoring systems which allow for the sensitive prediction of these patterns, should be given careful consideration.

References Cited

BELL, M.A. (1985) - "Smart Buildings as Preferred Locations", **Industrial Development**, September/October 1985

BLAZAR, W.A., Spector, M.E. and Grathwol, J. (1985) - "The Sky Above, The Teleport Below", **Planning**, December 1985

LONDON, City of (1986), City of London Local Plan, May 1986.

GAD, G.H.K. (1985) - "Office Location Dynamics in Toronto: Suburbanisation and Central District Specialisation", **Urban Geography**, 1985, Vol. 6, No. 4, pp. 331-351.

HEPWORTH, M.E. (1986) - "The Geography of Economic Opportunity in Information Society", **Information Society Journal**, Vol. 4, No. 3, June 1986

MOSS, M.L. (1985) - "The New Urban Telecommunications Infrastructure" paper presented for **Landtronics**, Lincoln Institute of Land Policy, USC, February 1985

PORAT, M. (1977) - **The Information Economy: Definition and Measurement**, U.S. Department of Commerce, Office of Telecommunications, Special Publication 77-12 (1), Washington

Appendix

Taxonomy of Information Occupations

Information Producers

Scientific and Technical
Examples: chemists and engineers

Market Search and Co-ordination
Examples: salesmen and buyers

Information Gatherers
Examples: surveyors and quality inspectors

Consultative Services
Examples: accountants and lawyers

Health-Related Consultative Services
Examples: Doctors and Vets

Information Processors

Administrative and Managerial
Examples: production managers and senior civil servants

Process Control and Supervisory
Examples: factory foremen and office supervisors

Clerical and Related
Examples: clerks and bank tellers

Information Distributors

Educators
Examples: school teachers and university lecturers

Public Information Disseminators
Examples: librarians and archivists

Communication Workers
Examples: newspaper editors and TV directors

Information Infrastructure

Information Machine Workers
Examples: computer operators and printing pressmen

Postal and Telecommunciations
Examples: mail carriers and telegraph operators